THIS OPINION WAS NOT WRITTEN FOR PUBLICATION

The opinion in support of the decision being entered today (1) was not written for publication in a law journal and (2) is not binding precedent of the Board.

Paper No. 20

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

Ex parte ROBERT H. BOND and MICHAEL J. HUNDT

Appeal No. 96-4180
Application No. 08/225,138[1]

ON BRIEF

Before BARRETT, FLEMING and FRAHM, ***Administrative Patent Judges***.

FLEMING, ***Administrative Patent Judge***.

DECISION ON APPEAL

This is a decision on appeal from the final rejection of claims 1, 2 and 5 through 12, all of the claims pending in the present application. Claims 3 and 4 have been canceled.

[1] Application for patent filed April 8, 1994. According to the appellants, the application is a continuation-in-part of Application No. 08/170,613, filed December 20, 1993, now abandoned.

The invention relates to an improved ball grid array integrated circuit package with high thermal conductivity. Appellants disclose on page 7 of the specification that Figure 2B is a cross section illustration of an integrated circuit package according to the preferred embodiment of the their invention. On page 9 of the specification, Appellants disclose an integrated circuit package having a substrate 16 having an opening disposed therethrough, a slug 14, formed of a material with high thermal conductivity (such as copper), having a bottom surface lying below the plane of the bottom of the substrate 16 and a top surface that is stepped so as to fit into the opening disposed in the substrate 16. Appellants also disclose that the integrated circuit package has an integrated circuit 12 attached to the top of the slug 14 and a plurality of solder balls disposed between the bottom of the substrate 16 and system circuit board 28. On page 11 of the specification, Appellants disclose that the slug 14 serves as a stand-off during solder reflow of the solder balls 24. Appellants teach that the shape of the solder balls 24 after reflow is determined in part by the collapse distance 26 as shown in Figure 1A. This is the difference between the length

of the slug 14 spaced from the substrate 16 and the diameter of the solder balls 24. Appellants further emphasize the importance of the collapse distance 44 in Figure 3, described on page 13 of the specification, determined by the slug 14.

The independent claim 1 is reproduced as follows:

1. A packaged integrated circuit, comprising:

a substrate having first and second surfaces, and having an opening disposed therethrough, and having a plurality of electrical conductors;

a slug, comprised of a thermally conductive material and having first and second surfaces, the first surface of the slug lying below the plane of the first surface of the substrate, wherein a portion of the second surface of the slug is connected to the first surface of the substrate, the remaining portion of the second surface of the substrate being exposed in the opening;

an integrated circuit chip, mounted to the exposed second surface of the slug, and electrically connected to the conductors of the substrate; and

a plurality of solder balls disposed at the first surface of the substrate and in electrical connection with the conductors of the substrate, for making electrical connection to a circuit board;

wherein the slug extends below the plane of the first surface of the substrate by a distance selected to define a desired shape for the plurality of solder balls when the integrated circuit package is mounted to the circuit board.

The Examiner relies on the following references:

Lin	5,222,014	Jun. 22, 1993
Higgins	5,291,062	Mar. 1, 1994
Ono[2] (Japanese Patent)	02058358	Feb. 27, 1990

Claims 1, 2 and 5 through 12 stand rejected under 35 U.S.C. § 103 as being unpatentable over Ono, Higgins and Lin.

[2] A copy of the translation provided by the U.S. Patent and Trademark Office, October 1996, is included and relied upon for this decision.

Rather than reiterate the arguments of Appellants and the Examiner, reference is made to the brief and answer[3] for the respective details thereof.

OPINION

We will not sustain the rejection of claims 1, 2 and 5 through 12 under 35 U.S.C. § 103.

The Examiner has failed to set forth a ***prima facie*** case. It is the burden of the Examiner to establish why one having ordinary skill in the art would have been led to the claimed invention by the express teachings or suggestions found in the prior art, or by implications contained in such teachings or suggestions. ***In re Sernaker***, 702 F.2d 989, 995, 217 USPQ 1, 6 (Fed. Cir. 1983). "Additionally, when determining obviousness, the claimed invention should be considered as a whole; there is no legally recognizable 'heart' of the invention." ***Para-Ordnance Mfg. v. SGS Importers Int'l, Inc.***, 73 F.3d 1085, 1087, 37 USPQ2d 1237, 1239 (Fed. Cir. 1995),

[3] In response to Appellants' appeal brief, the Examiner issues a letter, mailed July 25, 1996. We will accept the letter as an Examiner's answer, but suggest in the future the Examiner should follow the requirements recited in 37 CFR 1.193.

cert. denied, 117 S.Ct. 80 (1996) ***citing W. L. Gore & Assocs., Inc. v. Garlock, Inc.***, 721 F.2d 1540, 1548, 220 USPQ 303, 309 (Fed. Cir. 1983), ***cert. denied***, 469 U.S. 851 (1984).

Appellants argue on pages 8 through 11 of the brief that Ono, Higgins and Lin, together or individually, fail to teach or suggest a slug, comprised of a thermally conductive material where the slug extends below the bottom of the substrate so as to determine the specific collapse distance of the solder balls. Appellants have submitted a Declaration to provide evidence that none of the references recognize that a thermally conductive standoff can be used to define the height of the solder link in a ball-grid array package as well as a statement of the advantages of such an invention. Appellants further argue that even if all of the claimed elements were present in the references, the Examiner has not shown that these references could be properly modified to meet Appellants' claimed limitation.

As pointed out by our reviewing court, we must first determine the scope of the claim. "[T]he name of the game is

the claim." ***In re Hiniker Co.***, 150 F.3d 1362, 1369, 47 USPQ2d 1523, 1529 (Fed. Cir. 1998).

We note that Appellants' claim 1 recites "a slug, comprised of a thermally conductive material and having first and second surfaces, the first surface of the slug lying below the plane of the first surface of the substrate . . . wherein the slug extends below the plane of the first surface of the substrate by a distance selected to define a desired shape for the plurality of solder balls when the integrated circuit package is mounted to the circuit board." Therefore, Appellants' claim 1 recites the collapse distance as defined by the distance the slug extends below the plane of the substrate.

Upon a careful review of Ono, Higgins and Lin, we find that

neither reference teaches these above limitations as recited in Appellants' claim 1. We agree that Figure 4 of Ono discloses a slug 81 having the same shape as Appellants' disclosed slug 14 in Figure 2B. However, Ono discloses on page 13 that Figure 4 is a cross section of a prior art substrate for mounting electronic components. In the prior

art section, Ono states on page 3 and 4 that the prior art shown in Figure 4 was an attempt to improve heat dissipation. Ono further states that the Figure 4 prior art used lead pins 96 that are inserted into the through holes 92. Ono's Figure 4 does not teach that the slug 81 defines a critical distance for soldering or that the distance is useful to define a collapse distance of solder balls.

Higgins and Lin teach the use of solder balls, but neither reference suggests the use of a slug to define the critical distance for the collapse distance of the solder balls. We agree that Higgins teaches that conductive pins may be substituted by solder balls in column 5, lines 59-62. However, none of the references suggest that Ono's slug 81 should be used to define the collapse distance of the solder balls.

Furthermore, we fail to find any suggestion of modifying Ono to provide slug 81 as a way to define a collapse distance of solder balls as recited in Appellants' claim 1. The Federal Circuit states that "[t]he mere fact that the prior art may be modified in the manner suggested by the Examiner does

not make the modification obvious unless the prior art suggested the desirability of the modification." ***In re Fritch***, 972 F.2d 1260, 1266 n.14, 23 USPQ2d 1780, 1783-84 n.14 (Fed. Cir. 1992), ***citing In re Gordon***, 733 F.2d 900, 902, 221 USPQ 1125, 1127 (Fed. Cir. 1984). "Obviousness may not be established using hindsight or in view of the teachings or suggestions of the inventor." ***Para-Ordnance Mfg.***, 73 F.3d at 1087, 37 USPQ2d at 1239, ***citing W. L. Gore***, 721 F.2d at 1551, 1553, 220 USPQ at 311, 312-13.

We have not sustained the rejection of claims 1, 2 and 5 through 12 under 35 U.S.C. § 103. Accordingly, the Examiner's decision is reversed.

REVERSED

LEE E. BARRETT Administrative Patent Judge	)
MICHAEL R. FLEMING Administrative Patent Judge	) BOARD OF PATENT APPEALS AND INTERFERENCES
ERIC S. FRAHM Administrative Patent Judge	)

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